

Notice of Allowability

Application No.

10/826,219

Examiner

Jessee Roe

Applicant(s)

TALIEH ET AL.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the Reply filed 23 April 2007.
2. ☒ The allowed claim(s) is/are 5-7, 9-11, 16-18, 20-23, 45-47, 49-57 and 62-70.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

DETAILED ACTION

Allowable Subject Matter

Claims 5-7, 9-11, 16-18, 20-23, 45-47, 49-57, and 62-70 are allowed.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

BACKGROUND OF THE INVENTION

[0006] One other consideration in Cu plating is the "edge exclusion". Cu plating heads, such as the one described in commonly assigned, ~~co-pending~~ application serial no. 09/472,523, filed December 27, 1999, now U.S. Patent No. 6,612,915, titled WORK PIECE CARRIER HEAD FOR PLATING AND POLISHING, typically use contacts around peripheries of the wafers. Making electrical contact and, at the same time, providing a seal against possible electrolyte leakage is difficult.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] A general depiction of one version of a plating apparatus is shown in Figure 2. This apparatus can also be used for plating and polishing as disclosed in

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commonly assigned application serial no. 09/201,929, filed December 1, 1998, now U.S. Patent No. 6,176,992, titled METHOD AND APPARATUS FOR ELECTROCHEMICAL MECHANICAL DEPOSITION, and commonly assigned, ~~depending~~ application serial no. 09/472,523, filed December 27, 1999, now U.S. Patent No. 6,612,915, titled WORK PIECE CARRIER HEAD FOR PLATING AND POLISHING. The carrier head 10 holds the wafer 16. The wafer has the barrier layer and the seed layer (not shown in Figure 2) deposited on its surface, and therefore its surface is conductive. The head can be rotated around a first axis 10b. It can also be moved in the x, y, and z directions. A pad 8 is placed on an anode plate 9 across from the wafer surface. The pad surface may itself be abrasive, or the pad may contain an abrasive material. Pad designs and structures from the subject matter of commonly assigned, ~~depending~~ application serial no. 09/511,278, filed February 23, 2000, now U.S. Patent No. 6,413,388, titled PAD DESIGNS AND STRUCTURES FOR A VERSATILE MATERIALS PROCESSING APPARATUS, and commonly assigned, ~~depending~~ application serial no. 09/621,969, filed July 21, 2000, now U.S. Patent No. 6,413,403, titled PAD DESIGNS AND STRUCTURES WITH IMPROVED FLUID DISTRIBUTION.

[0029] Electrolyte 9a is supplied to the wafer surface through the openings in the anode plate and the pad as shown by the arrows in Figure 2. Commonly assigned, ~~depending~~ application serial no. 09/568,584, filed May 11, 2000, now U.S. Patent No. 6,478,936, titled ANODE ASSEMBLY FOR PLATING AND PLANARIZING A CONDUCTIVE LAYER, discloses an anode plate, while commonly assigned, ~~depending~~

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application serial no. 09/544,558, filed April 6, 2000, now U.S. Patent No. 6,354,916, titled MODIFIED PLATING SOLUTION FOR PLATING AND PLANARIZATION, the disclosure of which is incorporated by reference herein as non-essential material, discloses an electrolyte. The electrolyte then flows over the edges of the pad into the chamber 9c to be re-circulated after cleaning/filtering/refurbishing. An electrical contact 9d is provided to the anode plate. The anode plate turns around the axis 10c. In some applications, the plate may also be translated in the x, y, and/or z directions. Axes 10b and 10c are substantially parallel to each other. The diameter of the pad 8 is typically smaller than the diameter of the wafer surface exposed to the pad surface, although it may also be larger. The gap between the wafer surface and the pad is adjustable by moving the carrier head and/or the anode plate in the z direction. In one mode of operation, the workpiece (i.e., the wafer or substrate) may be brought close to the pad, without touching the pad. In this mode, during material deposition, the workpiece hydroplanes or floats over the pad or anode. In another mode of operation, the wafer surface and the pad may be in contact. When the wafer surface and the pad are touching, the pressure that is exerted on the wafer and pad surfaces can also be adjusted.

[0035] In the construction shown in Figure 4, the electrical contact to the wafer surface is made by way of a potential conductive pad 80. This pad 80 is used in place of the multiple pins 20. In this case, an insulating spacer 82 of ceramic or other dielectric material is placed directly over the anode plate 9' between the anode plate 9' and the conductive pad 80. Electrical supply contacts are made to the conductive pad

80 and the anode plate 9', and a cathodic potential is applied to the pad 80, with electrolyte 9a making physical contact to the anode plate 9', the pad 80 and the wafer surface 22. When the substrate or water 16 is brought down and engages the pad, it gets energized and the Cu plating on the wafer surface 22 commences. The construction shown in Figure 4 is similar to certain pad designs and structures forming the subject matter of application serial no. 09/511,278, filed February 23, 2000, now U.S. Patent No. 6,413,388, mentioned previously. Additionally, commonly assigned application serial no. 09/483,095, filed January 14, 2000, now U.S. Patent No. 6,630,059, titled SEMICONDUCTOR WORKPIECE PROXIMITY PLATING METHODS AND APPARATUS, discloses conductive pad strips used on cylindrical anodes. In other applications, the potential conductive pad 80 may be allowed to float with respect to the wafer surface 22 during material deposition or removal. The potential, moreover, may be pulsed to produce impulse plating. Again, the circuitry used for pulsing the potential is well known and commonly used.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jessee Roe whose telephone number is (571) 272-5938. The examiner can normally be reached on Monday-Friday 7:30 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JR


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